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FIXING COMPENSATORY MITIGATION: WHAT WILL IT TAKE?[1,2]

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Abstract. This study was undertaken to review the current status of permit-linked mitigation policies and practices in order to determine implications of the continued use of mitigation as a wetlands management tool within the United States. Based on reviews of both published literature and agency reports, our survey of past mitigation projects nationwide indicates that the success rate of permit-linked mitigation projects remains low overall. In addition, there is continuing difficulty in translating mitigation concepts into legal principles, regulatory standards, and permit conditions that are scientifically defensible and sound. Based on the record of past poor performance, we assert that continued piecemeal revision efforts focused on technical or scientific details are not likely to make compensatory mitigation more effective. There is need to acknowledge the extent to which non-scientific, real-world complications plague current policies and practices. To prevent continued loss of wetlands under compensatory mitigation, decisive action must be taken by placing emphasis on improving compliance, generating desired acreages, and maintaining a true baseline. Without selective changes in the status quo, current policies and poor implementation are likely to lead to further wetland losses.

Key words: compensatory mitigation; habitat mitigation; habitat replacement; man-made wetlands; mitigation failures; mitigation policies; permit compliance; restoration of aquatic ecosystems; wetlands management; wetlands mitigation; wetlands restoration.

It's deja vu all over again.
(attributed to Yogi Berra)

INTRODUCTION

In the space of two decades, mitigation has evolved from a seldom-used dictionary term to a heavily applied wetlands management practice that has become firmly entrenched with agency managers who are charged with the dual responsibilities of safeguarding the nation's wetlands and approving proposals for development. Questions about the advisability and success of mitigation projects surfaced over a decade ago (Race and Christie 1982), and persist in lively debates that continue to the present, bolstered by expanded scientific research and increased practical experience (e.g., Race 1985, Harvey and Josselyn 1986, Race 1986, Batha and Pendleton 1987, Zedler 1987, O'Donnell 1988, Redmond 1992). At the heart of the current debate is the practice of permit-linked compensatory mitigation: required actions that are intended to compensate for environmental damage or loss of habitat through replacement of functions, values, or acreage of wetlands proposed for destruction. Very often compensatory mitigation involves creation of new wetlands or enhancement of existing wetlands.

According to current federal policy, explicit trades between permitted impacts and mitigation requirements should not be allowed, and mitigation efforts should be "sequenced," with a preference for avoiding and minimizing wetland impacts before resorting to compensatory mitigation. However, with so much at stake in the permit process, the unfortunate reality is that discussions often focus heavily on compensatory mitigation as a means of offsetting habitat damage or loss. Although hardly responsible for the majority of national wetland losses, the practice of compensatory mitigation remains a serious concern because it is a bartering scheme that trades permission to damage a known quantity of wetland area for the promise of some kind of replacement, sometimes at locations away from the impacted area. The manner in which this bartering is pursued varies widely under local, state, and federal agencies whose jurisdictions overlap in wetlands. Thus, the process of planning and permitting compensatory mitigation projects is not at all consistent.

In this paper we take a renewed look at mitigation in a broad context and ask once again whether mitigation—as currently conceived in policy and applied in practice—is a useful wetlands management tool or, rather, an option that inevitably contributes to further incremental loss of habitats regionally and nationally in response to persistent demands for development permits.

[1] Manuscript received 14 July 1994; revised 3 March 1995; accepted 8 March 1995.

[2] For reprints of this group of papers on wetland mitigation, see footnote 2, page 33.

Background

In reviewing the literature, it became clear we can add little that has not already been said in the mitigation debate. Every year, there are conferences in the United States with mitigation or restoration as a theme (e.g., Annual Symposium on the Restoration and Creation of Wetlands, Hillsborough Community College, Tampa, Florida). Moreover, several texts have addressed the full spectrum of mitigation issues (Kusler and Kentula 1990, NRC 1992, Thayer 1992). Each volume provides summaries of definitions, analyses of scientific advances, and discussion of protocols and guidelines for a variety of wetland mitigation, restoration, and creation options. It is clear that the field has progressed considerably since a time when there "was no consistent definition of what [mitigation] was nor any consensus as to how it should be applied" (Race and Christie 1982).

While the proliferation of studies about mitigation is both encouraging and helpful, it is interesting to note that much of the work on mitigation remains outside the peer-reviewed literature. A computer search using BIOSIS revealed only 44 citations since 1987 for mitigation when the word was combined with the terms habitat, or wetland, or ecosystem. In addition, many of these entries were abstracts. In our opinion, this lack of peer review represents a serious flaw in the evolution of mitigation technology and philosophy.

If there is so much scientific and practical information about mitigation, why is there a lingering undercurrent of doubt about compensatory mitigation (Roberts 1993)? Part of the reason may come from its continuing close association with, and reliance on, restoration ecology. The National Academy of Sciences report on aquatic ecosystem restoration (NRC 1992) emphasizes the tremendous potential of restoration techniques for replicating lost functions and values as well as former plant and animal communities. In fact, the report advocates a goal of "restoring 10 million wetland acres" (4.05×10^6 ha) over the next 18 yr throughout the nation. However, as noted by Nicholas (1992):

> *one of the report's major contributions is an honest picture of the present state of wetland restoration—rudimentary, at best; criminally inept, at worst. The lack of knowledge about wetland functions and values and the lack of a larger planning context in which restorations are carried out are identified as serious limitations in ongoing efforts.*

According to the NRC (1992) report, mitigation efforts cannot yet claim to have duplicated lost wetland functional values; nor has it been shown that restored wetlands maintain regional biodiversity or recreate functional ecosystems.

Further doubts about compensatory mitigation are raised from reviewing the outcome of actual mitigation projects in the field. Despite evolving sophistication by the research and management community, the results are not encouraging, and the success of mitigation remains in serious doubt.

Surveys of Mitigation Projects

Race (1985) contended that premature extrapolation of experimental results led to institutionalization of mitigation as a policy with little to suggest that it fulfilled expectations of restored ecosystem function. She based this conclusion on a review of 6 yr of permit history and surveys of 33 restoration projects located in San Francisco Bay. In general, noncompliance with permit conditions was the norm. Unfortunately, these findings were not unique.

Eliot (1985) reviewed 58 mitigation projects in San Francisco Bay that had been permitted over a 6-yr period. She found they did not adhere to established mitigation policies, they were frequently unsuccessful, and almost half of the projects had not been accomplished by the specified permit completion date. She advocated effective enforcement as the key to mitigation project completion, noting that its absence accounted for much of the noncompliance among permits in her study. She also noted that mitigation ratios (ratio of habitat replaced to habitat lost) varied widely among projects and were not consistently used to determine the acreage of compensating projects. This kind of arbitrariness all but guarantees opposition and legal challenges from developers, who generally feel that current wetlands policies are unfair and inequitable anyway (Wilmar 1986, Wilms 1990).

Quammen (1986*a*) reviewed studies of mitigation projects in various parts of the country, including Virginia, New England, New Jersey, Florida, and San Francisco Bay. She concluded that on the whole:

> *compliance with permit conditions is low and that effectiveness of restoration to compensate for wetland losses cannot yet be determined. Only when the project objectives and design criteria are clearly stated as part of the permit conditions, and monitoring is conducted and reported, will we be able to evaluate whether created wetlands are able to compensate for the losses in natural wetlands.*

A New Jersey field survey and qualitative evaluation of 30 artificial salt-marsh projects (wetland permit and violation cases) revealed an array of problems including wave damage, sedimentation problems, deteriorating bulkheads, and unplanned shifts in species composition (Shisler and Charette 1986). Additional detailed quantitative sampling at eight of the sites indicated significant differences in nearly all sediment characteristics, vegetational parameters, and macroinvertebrate measures when compared to adjacent natural marshes. The authors concluded that the "restoration and creation of artificial marshes is in an early state of development . . . and their long-term success under var-

ious environmental conditions still needs to be experimentally tested."

R. A. Cobb[3] conducted surveys of a wide variety of wetland mitigation sites in Texas and concluded that permitted activities led to a 0.6:1 ratio of habitat replacement to loss. He concluded that conflicting goals among agencies, lack of customized plans, lack of performance bonds, inexperience, and absence of a structure to assure long-term accountability for the maintenance of a site all conspired to produce meager results.

A report by the Staff of the Bay Conservation and Development Commission (BCDC 1988) evaluated the success of 14 permit-associated mitigation programs involving tideland restoration in San Francisco Bay. They reported that "mitigation programs can and, in most cases where work has been adequately performed, have successfully created and enhanced Bay resources." However, their criteria for success were based on whether a completed project met the permit's specific mitigation requirements, rather than how well it replaced or offset the specific, adverse Bay-related impacts of that project (compliance vs. functional success as described by Quammen 1986*b*). They noted (BCDC 1988) that "while many of the mitigation projects were successful, some well-designed projects have yet to create the desired resources," suggesting the need for mitigation areas "that are larger in size and greater in resource value than the area disturbed by the . . . project." Five of the 14 projects experienced some delay in completing all or a portion of their mitigation requirements as a direct result of being unable to either find and/or acquire a suitable restoration site. The report recommended a number of ways to increase overall success including increased attention to enforcing mitigation requirements, greater specificity in prescribed mitigation plans, and requiring that mitigation work begin prior to undertaking the actual permitted project.

In a comprehensive Florida study, the Florida Department of Environmental Regulation (FDER) revisited 119 habitat-creation, enhancement, or preservation sites covered under 63 permits (*unpublished report* submited to Governor L. Chiles [5 March 1991]).[4] The survey found that only 6% of the permits were in full compliance, and that in 34% of the permits no mitigation had even been attempted—although losses of natural habitat had gone forward. Interestingly, permits for tidal areas fared better than freshwater sites, with 27% vs. 12% "ecological effectiveness." To counter these losses, the report suggested that more staff, greater upfront mitigation, filing-fee assessments, and administrative fines for noncompliance were needed to counter habitat losses.

Lewis (1992) combined the FDER study findings with data from two other Florida studies of mitigation projects (D. W. Crewz, *unpublished report* [Mid-project, 1990];[5] K. L. Erwin, *unpublished report* [1991][6]) and reported: "Taken as a whole, these three studies looked at 174 regulatory agency-permitted mitigation projects and concluded that only eight achieved compliance with all permit requirements. That's only a 4.6% success rate . . ."

A detailed audit by the Florida Department of Environmental Regulation reviewed the specifics of >1300 permits, representing ≈10% of all dredge-and-fill mitigation permits during a 5-yr period (FDER, *unpublished report* [1991; Audit Report number AR-249]) (see footnote 4). Their reviews included subsamples of permit files and compliance records as well as inspection of actual mitigation sites and interviews with applicable personnel. The audit reported inadequate record keeping and poor tracking of wetlands mitigation data, a high rate of noncompliance with permit conditions by permittees, inconsistencies in permit conditions within and among Department offices, and inadequate inspections and enforcement. For example, the audit found that 43% of the mitigated permits did not have conditions considered to be adequate and readily enforceable. Only 39% of the permittees had fully complied with the permit conditions in the required time; many projects had not even been started, while others were found to be in noncompliance for reasons including improper elevations, incorrect amounts or types of vegetation, inadequate monitoring or maintenance, and inadequate size or configuration. Only 8% of the freshwater sites and none of the tidal sites were evaluated as being *ecologically* successful, and 28% were so unsuccessful that major remedial action was recommended. The auditors concluded that "the wetlands mitigation program has generally been ineffective," and that despite some recent improvements, many problems remain.

Mager (1990) documented the existence of at least 763 permitted projects and echoed concern about the lopsided, upfront attention given to mitigation proposals as compared to follow-up: "There is virtually no follow-up once a permit is issued and the ultimate fate of thousands of acres of wetlands is unknown." These concerns are especially serious when one considers national trends. As noted by Zedler (1996*a*), a U.S. Environmental Protection Agency (EPA) review of permit records for eight states over the past two decades documented 724 permits in the cumulative record, with 898 wetlands impacted and 745 compensatory wetlands required.

The serious shortcomings of mitigative activities

[3] *Unpublished report* (1987) to U.S. Fish and Wildlife Service, Corpus Christie, Texas, USA.

[4] Available from Florida Department of Environmental Regulation, Tallahassee, Florida, USA.

[5] Available from Mana-Sota-88, 5314 Bay State Road, Palmetto, Florida 34211 USA.

[6] Available from South Florida Water Management District, 3301 Gun Club Road, P.O. Box 24680, West Palm Beach, Florida 33416-4680 USA.

have also been expressed by others (Newman 1986). Recently, the Committee on Restoration of Aquatic Ecosystems advised against the use of wetland restoration to offset or justify the destruction of other wetlands until wetland restoration science has moved from a trial-and-error process to a more predictive science (NRC 1992). Subsequently, a review article in *Science* noted the sober reality that under present mitigation policies and practices "losses are likely to be uncompensated for and that what we call mitigation has a high chance of failure" (Roberts 1993). Experts interviewed for that article expressed the consensus that "compensatory mitigation should be the last resort, and must be based on the best available science, with strict, agreed-upon standards to judge success, perhaps by a government agency or private groups, and a commitment by developers to make mid-courses corrections when needed—what Zedler calls 'adaptive management' of the ecosystem." Furthermore, the article concludes with the suggestion that regulatory agencies should require, whenever feasible, that the replacement wetland be completed up front, before the natural one is destroyed.

Discussion

Based on over a decade of survey results, the cumulative record of past mitigation projects remains undeniably poor overall, with disappointingly few examples of success. With hindsight, there are undoubtedly many persuasive explanations for poor performances or partial successes—including inadequate design, poor hydrology, improper location, wrong contours, incorrect elevation, small size, poor sediment characteristics, lack of skill by constructors, invasion of exotic species, exposure to severe storms, vagaries of nature, or surveys performed too early in the developmental stage to demonstrate success. It is not our intention to reanalyze past projects with the goal of identifying and systematically ranking the reasons for poor performance. In our opinion, such a task would be both unnecessarily costly and unproductive. Rather, it is time to admit the limitations in both our knowledge and our ability to gain additional information in a timely fashion. As discussed by Ludwig (1993), there comes a time when it is advisable to seek resolution to resource management issues outside the traditional scientific realm. While there is certainly need for continued scientific and on-site research, it is *doubtful whether additional scientific information will be sufficient to resolve the current problems of compensatory mitigation* or make it more effective. In the face of escalating political attacks on wetlands protection efforts and the apparent necessity of continuing to use mitigation as a wetlands management tool, it is arguably more important to explore ways to improve overall mitigative performance as soon as possible. It is also important to acknowledge a number of real-world complications that are likely to frustrate attempts to improve compensatory mitigation policies and practices.

Tensions between a landscape approach and existing permit policies

Over the years the conceptual view of environmental impacts has evolved significantly, from an early perspective that assessed mainly direct project impacts, to a later view that focused on cumulative impacts, and most recently to a landscape approach. This evolution in perspective has not been accompanied by corresponding shifts in the wetlands permit process. For example, there is considerable debate about the correct scale over which to evaluate wetland functions and impacts to them. Bedford and Preston (1988) and Zedler (1996*b*) argue persuasively that the inability to document cumulative impacts has resulted in a continued focus on impacts bounded by the arbitrary definitions of a given project, without proper consideration of the linkages between communities and ecosystems. This disparity between landscape planning goals and individual projects often conflicts with individual property rights, thereby setting severe limits on the use of landscape approaches with compensatory mitigation.

The problem is largely a social one; we are a society that has not progressed past the frontier economics that initially categorized wetlands as a resource to be reclaimed, and that emphasizes private-sector goals over public concerns (M. E. Colby, *unpublished report*).[7] How, in the absence of strict environmental oversight, can a landscape approach be utilized in compensatory mitigation? Barring significant erosion of private property rights, we submit that it cannot. Depending on the scale chosen, landscape management may encompass literally thousands or millions of individual property owners. Taking a large-scale, ecosystem approach to wetlands management is a significant change in natural resource management policies, one representing a major paradigm shift that will require radical revision in values, management practices, and institutional structures in order to succeed (Cortner and Moote 1994).

Maintaining consistency in the permit process is critical if we wish to avoid problems caused by conflicts with private ownership and questions over legal "taking" of land or inequitable government compensation for land in question. Thus, integrating ecologically relevant concepts such as landscape-scale decision criteria need more than good science; it will also require conscious redesign of the entire permitting infrastructure to avoid legal challenges. If developers are not offered what they perceive as rational alternatives, we should not be surprised to see them respond by litigating against compensatory mitigation (Wilmar 1986).

[7] Policy planning and research working paper series, publication number WPS 313. Available from Strategic Planning and Review Department, The World Bank, New York, New York, USA.

Currently, review of mitigation requests is on a case-by-case basis (and will likely remain so for a long time), a process that explicitly recognizes private ownership of land and presumably treats all projects with the same set of guidelines or requirements. Adopting a landscape approach to compensatory mitigation may generate unanticipated legal complications. For example, later permittees might face more stringent controls or requirements because of cumulative impacts to the regional ecosystem caused, in part, by earlier permittees. For the landscape approach to guide compensatory mitigation projects, there must be an acceptable mechanism to justify changes in permitting criteria while balancing individual property rights. The practice of adaptive management—utilizing post-approval monitoring, changes in performance standards, revisions of compliance criteria, and repeated corrective measures—could result in charges of inconsistency or capriciousness if regulators repeatedly change the rules and requirements for permit holders.

Exemptions, small cumulative losses, and continued erosion of the wetlands baseline

Gladwin and Roelle (1992) noted that exemptions under the Corps of Engineers Nationwide Permit 26 program (authorizing discharges in "<10 acres" (4.1 ha) of wetlands)[8] cause significant unrecorded wetlands losses from many small impacts. The current structure of permit and exemption processes virtually guarantees incremental, cumulative loss of wetlands. This means that failed mitigation projects or other small losses will not be detectable until their cumulative impact is seen on a very large scale. When detectable, these cumulative losses would indicate an alarming state of decline where remedial action is bound to be prohibitively expensive.

In some quarters there is optimism that remote-sensing technology can be brought to bear upon cumulative impact problems and landscape-scale wetlands management. In order to guide compensatory mitigation planning, the resolution of the landscape assessments must be consistent with the physical size of the compensatory mitigation projects. Rivera et al. (1992) determined that, depending on the sensing technology, 36–68% of the projects being approved for wetland alterations occurred below the detection limit of the technologies at hand. Although new technologies can provide resolution at <1-m scales, such as those being used in San Diego Bay (J. Zedler, *personal communication*), it may be some time before these are used nationwide. The sheer mass of data that would be processed for watershed-scale maps with 1-m resolution seems sufficiently costly at present to inhibit regional planning processes. Further, expecting routine high-resolution mapping of individual mitigation projects seems unrealistic given the widespread lack of follow-up and monitoring. At least for the foreseeable future, remote sensing will probably not provide oversight data for small mitigation projects nor aid in quantitative assessment of their cumulative impacts. Without accurate information on acreages of historical and current losses, it is difficult to address questions such as "what is the baseline level of habitat?" and "to what standard do we compare the extant acreage?".

Many resource managers argue that mitigation is better than getting nothing at all in return for coastal development projects that would otherwise proceed with no recompense for environmental degradation. We disagree. In the short term, mitigation projects that do not meet the no-net-loss criteria become a liability in the effort to sustain local ecosystem functions. Over the long run, wetland management policies that allow development before the delivery of prescribed mitigative compensation contribute to the downward spiral of cumulative habitat loss. These losses may have to be offset by other projects that must provide higher ratios of replacement acreage to lost acreage for compensation. Without overcompensation through other projects, the "better something than nothing" approach constitutes a tacit approval of accepting net loss of habitat.

Recommendations

As described above, vexing problems continue to plague the policies and practices of compensatory mitigation. There is great difficulty in translating mitigation concepts into legal principles, regulatory standards, and permit conditions that are scientifically defensible and fair. Despite the dedicated efforts of researchers, practitioners, and regulatory officials nationwide over the past decade, there remains no universally accepted standard for required compensation—a situation that, in our opinion, is likely to persist for some time, even in the face of expanding research in restoration ecology.

While we agree there are many ways to reduce the risks of failure in wetlands restoration projects (e.g., NRC 1992: Chapter 6), it is important not to be overly optimistic that either more research, more time, more highly trained consultants, or more money will necessarily mean reduced failure rates. Even when wetland restoration experts have adequate budgets, ample time, extensive on-site experimental data, and the ability to take an adaptive management approach, functional success cannot be guaranteed (Zedler 1996*b*).

The permit process is still significantly ahead of the scientific debate regarding issues such as functional equivalency, biological diversity, and reconstruction of landscape patterns. Questions about substitute wetlands will no doubt continue even as additional permits are issued. Until we begin to approach at least rudimentary

[8] The Clean Water Act (1972) authorized the Corps of Engineers to issue permits for discharges of dredge or fill materials in the waters of the U.S. Also, the Corps was given additional permit authority in 1984 under the Nationwide Permit 26 Program (NWP 26) which allows fill of <10 acres in non-tidal wetlands.

compliance on a regular basis (such as actually initiating the work), no one will be able to determine whether these habitat exchanges can be justified on scientific grounds. Getting to compliance is the key. There is ample reason to believe that compensatory mitigation can still work—but only if we act decisively to implement some of the many insightful recommendations that have already been put forth in the literature.

Activities aimed at improving compliance

A stronger emphasis on permit compliance and enforcement is needed to improve the overall success rate of mitigation projects (Redmond 1992). Up-front completion of mitigation projects will help the situation, but only if there is some way to monitor, verify, and enforce actual compliance *prior* to commencement of the development project. Even if compliance levels eventually approach 100%, we must continue to monitor and evaluate functional equivalency of the mitigated habitat vs. the natural area that it replaces.

As noted by Lewis (1992), mitigation programs currently lack the tools necessary to enforce and ensure success of wetlands creation and restoration projects or even to see that they get done. Several factors combine to deter agencies from vigorous enforcement including the actual dollar costs of enforcement, the political costs of added staff, and the political costs of prohibiting development (Jensen 1987). Despite these problems, agencies must reconsider the issue of enforcement and monitoring, exploring ways to increase effective oversight of mitigation projects and ensure their compliance with permit conditions. Unless enforcement and monitoring are emphasized, noncompliance will likely continue as the norm, because there are no penalties or incentives for a permit holder to adhere to permit conditions.

In seeking to address the problems of noncompliance and lack of enforcement, there is need to plan carefully and avoid pitfalls associated with proposed solutions. For example, Wold (1990) described the problem caused by disparity of fine assessments for NOAA's [National Oceanic and Atmospheric Administration] civil penalty policy for overfishing. He concluded that the fines were so low in contrast to the benefits of overexploiting the resource as to not be a deterrent, and that inconsistent application of fines led to litigation because of perceived unfairness. Proposed penalties or incentives that seek to improve compliance must be considered in light of the beneficial services of functional wetlands (e.g., erosion control, primary and secondary production, aesthetics, etc.). With wetlands, various approaches that either penalize or provide incentive to a permit holder can be found, including performance bonds, civil fines and penalties, mitigation banking, and in lieu fees. Because none of these approaches, especially mitigation banking, is without problems (King 1992, Lewis 1992, King and Bohlen 1994), resource managers should review how these alternatives contribute to overall compliance and no-net-loss-of-wetlands goals.

We strongly advocate that restoration and/or mitigation be *on site* and *in kind* as it has the greatest potential to minimize disruption of remaining ecological functions (by recognizing the importance of position in the landscape as opposed to simply quantities of habitat). This tactic should be especially emphasized in areas where significant ecological linkages and functions still exist. However, in highly disturbed settings such as urbanized areas where substantial habitat fragmentation has already occurred and ecological functions may be further impaired by the very act of mitigation (e.g., mobilization of hazardous materials during recontouring), alternatives such as mitigation banks may be a more realistic solution, albeit not without problems. Clinging to a landscape perspective in extremely fragmented or polluted settings makes little ecological sense in locations where the landscape has essentially vanished. Whatever actions are taken to increase compliance with permit conditions, they must truly lead to effective prohibition of wetlands degradation.

Clearly, alternative approaches must be executable in the face of tight budgets and conflicting agency mandates. One suggestion to improve compliance might be implementation of an approach similar to that used by the U.S. Internal Revenue Service (the tax-collection branch of the U.S. federal government), with audits, fines, and civil penalties. Such an approach may be tractable for agencies, both politically and economically. The idea is not to survey every permitted project after the fact, but to randomly choose projects and hold them to the strict criteria put forth in the permit conditions. The uncertainty of such an *audit* may well provoke much-needed attention to detail in mitigation projects. In addition, any fines that were generated for noncompliance could be used for actual habitat restoration purposes if they are so earmarked. By establishing expectations of audits for performance and compliance, repeated mistakes by unqualified practitioners would eventually be discouraged.

Budget reallocations

We recognize that any recommendation to increase monitoring, enforcement, and compliance-related activities will necessarily require a reexamination of how agency dollars are allocated. In general, agency dollars have been divided among tasks such as damage assessment; permit reviews and negotiations; inventory and resource surveys; research and development; and, to a lesser extent, enforcement and compliance. Assuming that increased funding will not be available, it may be necessary and advisable to reallocate funding in ways that emphasize permit compliance, even if this means de-emphasizing some research and inventory tasks, especially coarse-scale, dated inventories.

Focus on generated acreage and establish a true baseline of acreage

Many researchers have commented on the lack of information comparing important biological functions of human-made and natural wetlands. However, in our view, concerns about function are eclipsed by concerns about generating habitat in the first place. The main priority should be on actually generating the acreage of habitat for which permits have been written. Once acreage is assured, only then does it make sense to emphasize the debate over how to measure wetland quality, function, natural equivalency, or persistence. If required acreage is not being delivered on a regular basis, then permit conditions must be strengthened.

Conclusions

As we noted at the outset, the issues in the debate over mitigation are not new, and neither are our recommendations. In fact, much of what we have discussed echoes the collective wisdom of researchers, practitioners, and agency managers, who for years have been making individual recommendations about their particular situations. The time has come to act deliberately on these collected recommendations with the aim of improving overall mitigation success. Certainly, this means applying technical skills and scientific knowledge; but it also requires an appreciation of the socio-political context of that work.

In this spirit, we suggest the need to plan strategically and prioritize actions selectively in order to realize a true no-net-loss of wetlands. We must avoid continued piecemeal revision efforts focused on technical or scientific details that are not likely to make compensatory mitigation a more effective management tool. The time has come to refocus compensatory mitigation efforts in a way that acknowledges underlying problems linked with unavoidable cultural, political, development, economic, and institutional constraints. This in no way undermines the importance of scientists or restorationists in the process; everyone must take a larger view of the mitigation process, translating and implementing their findings where appropriate. But to prevent continued losses of wetlands under compensatory mitigation, we must reorder our priorities, putting emphasis on improving compliance, generating desired acreage, and maintaining a true baseline. Unless we change the status quo of compensatory mitigation, we fear that the baseline of wetlands acreage will continue to erode in the face of faulty policies and poor implementation. We think the system is fixable, but only with deliberate, selective changes. In our optimistic moments we look forward to a time when review papers like this are not a decadal event.

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